ABSTRACTS FROM ASTRONOMICAL PUBLICATIONS.

A Chinese Star Catalog.

About the same time that Bradley was working out his system of star positions, with the accurate methods and refined mural quadrant of the Greenwich Observatory, three European Jesuit missionaries in China and a few Chinese men of science were engaged in the construction of astronomical instruments and were endeavoring to define the limits of, and to count the number of, stars in each constellation.[1] The description of a huge armillary sphere and the memoirs relating to the star observations were embodied in the Chinese book, *K'in-ting-i-siang-k'ao-tch'eng*, which, in plain English, means instruments made by order of the emperor. Out of the five catalogs contained in the book, the first is an abridged catalog, in which the stars are divided into the classical Chinese 3 *yuen* and 28 *sieou;* the second and third are complete catalogs, the difference being the arrangement of stars according to longitude in the second and according to right ascension in the third; the fourth is a catalog of stars less than 10° from the ecliptic, subject to occultation by the Moon and planets; the fifth is a catalog of galactic stars. It is to the Observatory of Zo-Sè, China, founded and supervised by the French Jesuit Mission of China, that we owe the publication of these abridged and complete star catalogs, and astronomers are indebted to Rev. P. Tsutsihashi, S. J., for the reduction of the stars of the catalog to the epoch of 1875.0 and for the revision of the Chinese catalog.[2]

Complete Catalog.—In the complete catalog, the stars are arranged in order of right ascension and grouped into 12 signs or *kong*. Both equator and ecliptic are divided into 12 parts

[1] A description of some of the old instruments of the Pekin Observatory, looted by the French and German troops in 1900, appeared in the *Scientific American Supplement*, No. 1304, December 29, 1900, and was reprinted in the *Smithsonian Institution Report* for 1900, pages 185-186.

[2] *Annales de L'Observatoire Astronomique de Zô-Sè*, tome VII, année 1911, published in 1914.

of 30° each, designated by the same name. The catalog, as published by the Zo-Sè Observatory, gives for each of the 3,083 stars, 1° a current number, 2° the Chinese name of the star, 3° the right ascension for 1744 in degrees, minutes and seconds, 4° the precession in right ascension in seconds and thirds, 5° the declination for 1744, 6° the precession in declination in seconds and thirds, 7° the right ascension for 1875, in hours, minutes and tenths of a minute, 8° the declination for 1875 in degrees and minutes, 9° the European and scientific name of the star. Numbers 1 to 6 are the plain translation of the Chinese data; numbers 7 to 9 were computed by Rev. P. TSUTSIHASHI, S. J.

Abridged Catalog.—According to the Chinese author, information about the numbers of constellations can be derived from three early Chinese catalogs. First, the astronomical section of the history of HAN gives the number of constellations as 118 and of the stars as 783. Second, the history of TSIN refers to a chart of 283 constellations and 1,464 stars. Third, the astronomer, NAN HOAI-JEN, namely, Rev. P. VERBIEST, S. J., made a catalog of 259 constellations containing 1,129 stars. While 24 constellations and 335 stars, known to earlier Chinese astronomers, are not recorded in VERBIEST's catalog, 597 stars and 23 southern constellations with 150 stars were added. The purpose of the Chinese authors of the present catalog was to revise and correct the old star catalogs, by measuring the distances between the stars, computing their positions, observing the forms of the constellations and recording them on a chart. The conclusion of the author, which gives an idea of the uranographic knowledge of the Chinese in 1744, is that there are 300 constellations, containing 3,083 stars. For the interest of the reader, I have compiled in the following table the number and name of the 28 *sieou,* the number of constellations in each, the number of stars found in early catalogs, the number of stars added in the new, and the number of stars recorded in the old catalogs that could not be found by the Chinese author of the present catalog:—

Sieou Number	Sieou Designation	Constellations	Number of Stars Old	Number of Stars New	Number of Stars Missing
1	The Abode of the Horn	11	41	47	4
2	The High Residence	7	22	26	..
3	The Low Residence	11	35	41	19
4	The House	7	21	14	..
5	The Heart	2	5	8	10
6	The Tail	5	21	12	..
7	The Fan	3	8	1	..
8	The Bushel	10	52	40	10
9	The Ox	11	54	81	10
10	The Woman	8	54	65	1
11	The Funeral Hillock	10	34	22	..
12	The Ridge	10	50	70	6
13	The Spouse	10	106	46	3
14	The Wall	6	21	52	7
15	The Sandal	9	42	53	3
16	The Harvest-Woman	6	33	64	..
17	The Grain-Keeper	7	39	57	..
18	Mao	9	47	37	..
19	The Thread	14	89	84	3
20	The Beak	3	16	17	..
21	The August	6	25	49	..
22	The Well	19	63	124	7
23	The Manes	6	29	57	..
24	The Willow	2	11	15	..
25	The Stars	4	31	95	..
26	The Arc	1	6	4	..
27	The Wing	1	22	7	..
28	The Car	2	14	8	..

In all probability, the missing stars are to be explained by varying atmospheric conditions and the different physiological dispositions of the observer, if the explanation of a very few cases is not to be found in the minima of variables and very rare temporaries.

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LICK OBSERVATORY, MOUNT HAMILTON,
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SPECTRA HAVING BRIGHT LINES, BY ANNIE J. CANNON.[1]

According to Miss CANNON, "Stellar spectra having bright lines may be divided into at least six classes," and the total number of known celestial objects with bright lines in their

[1] *Annals Harvard College Observatory*, **76**, 19, 1914.

spectra is 750. The paper, of which this note is an abstract, discusses the first four of these classes—gaseous nebulæ, Class P; stars of Class O; stars of the P *Cygni* type, having bright lines superposed on a continuous spectrum; and Novæ. The discussion is based mainly upon photographs taken with the 8-inch Draper telescope at Cambridge and with the 8-inch Bache telescope at Arequipa.

The four classes of objects are considered separately and are tabulated in convenient form for reference. The table of gaseous nebulæ gives for each object the position for 1900, with galactic co-ordinates added, and then, in nine columns, the intensities of the principal bright lines observed. In the tables for the stellar objects the intensities and identifications of the bright lines are omitted, but the Class O stars and the Novæ are divided into sub-classes according to their spectral peculiarities. The explanatory notes to the tables describe individual peculiarities, and give references to the literature of the subject.

Two plates are added to illustrate the various spectra with bright lines. R. G. AITKEN.

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THE MULTIPLE SYSTEM, ZETA CANCRI.

Zeta *Cancri* consists of a moderately close bright pair of stars (A and B), which form a binary revolving in nearly circular orbits with a period of about sixty years. A third bright star C revolves about the center of gravity of the binary pair in a much larger orbit, its motion so far as observed being approximately on the arc of a circle. There are, however, irregularities or anomalies in its motion which, because of their periodic recurrence, were ascribed by OTTO STRUVE and by FLAMMARION to the influence of a fourth star (D) near C and too dark to be visible in a telescope.

About twenty-five years ago, SEELIGER made a very thoro study of the measures of the three stars in the system, with special reference to the anomalies in the motion of C, and found that these could be entirely removed if we assume that C is attended by a dark companion, D, the pair revolving in nearly circular orbits at a mean distance of about 0″.2 and in a period of a little less than eighteen years.

BURNHAM disputed this conclusion and considered that the observed irregularities in the motion of C about AB were simply due to the accumulation of systematic errors of measure. As a test of the question he proposed that measures be made of the difference in declination between C and a star (β 1243) independent of the system, which follows about 2^m and is about 104″ north of C. He began such measures with the 36-inch telescope in 1891 and he and BARNARD continued the series regularly with that instrument, and, later, with the 40-inch of the Yerkes Observatory until 1905. BURNHAM added a later set in 1910, and at this time wrote: "There is nothing in these measures, begun in 1891, to indicate any variable motion in C."

Casual inspection would seem to support this conclusion, for the measures are remarkably accordant, and when reduced to a common epoch (1900.0) show apparently only a regular progressive increase in the distance due to the known relative proper motion of the two stars. SEELIGER, however, in a recent article in the *Astronomische Nachrichten*[1] finds that, on closer analysis, they fully support his earlier investigation. If the measures are corrected simply for the relative proper motion and the mean is taken, the average residual of the measures from this mean is ± 0″.14, the range 0″.56. This would not be excessive in measures of this kind; but the residuals show a marked systematic run, being large and negative in 1891-1895, large and positive in 1899-1902, nearly zero in 1903-1905, and large and negative in 1910. When the correction for the orbital motion of C about the hypothetical star D is applied, the average residual is reduced to ± 0″.06, the range to 0″.29, and the systematic change of sign entirely disappears.

These measures, therefore, clearly support SEELIGER's hypothesis, and the present investigation taken in connection with his former researches, satisfactorily establishes his finding that ζ *Cancri* is a quadruple system. R. G. AITKEN.

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[1] *Astronomische Nachrichten*, **199**, 273, 1914.